

THE BIOLOGIST

A Quarterly Journal Promoting Research
Interest in the Biological Sciences

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May

1958

IN THE PHI SIGMA CHAPTER:

The President —

1. Calls and presides at Chapter and Executive Committee meetings.
2. Conducts Initiations and Installations as Custodian of the Ritual.

The Vice-President —

1. Acts for and in the absence of the President.
2. Is Chairman of the Membership Committee and directs its activities.
3. Is a member of the Executive Committee.

The Secretary —

1. Takes Roll Call at all Meetings.
2. Conducts all current Official Correspondence.
3. Keeps a file of all Chapter Correspondence.
4. Reports all Membership Elections to the Council Secretary.
5. Reports number of BIOLOGISTS needed to the Council Treasurer and Editor.
6. Distributes BIOLOGISTS to all Honorary, Faculty and Chapter Members.
7. Is Custodian of the Permanent File of all members.
8. Is Custodian of the Chapter Insignia and the Charter.
9. Is a Member of the Executive Committee.

The Treasurer —

1. Collects all Membership Fees and Local Dues.
2. Pays all Chapter local bills.
3. Transmits all Membership Fees to the Council Secretary-Treasurer.
4. Is a Member of the Executive Committee.

The Editor —

1. Promptly reports all news-worthy Chapter Activities to the Council Editor.
2. Acts as Public Relations Officer for the Chapter.
3. Is not a voting member of the Executive Committee.

The Council Representative —

1. Functions for and with the Council Secretary in default of the local Chapter Officers.

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**DR. L. H. SNYDER BECOMES PRESIDENT OF
UNIVERSITY OF HAWAII**

News that he is President-elect of the University of Hawaii comes to Dean L. H. Snyder and Mrs. Snyder. Dr. Snyder is Honorary President of the Council of Phi Sigma. Photo courtesy Honolulu Star-Bulletin.

EDUCATION FOR A SCIENTIFIC AGE

Laurence H. Snyder

The education of our citizens, and especially of our young people is a responsibility in which each of us, directly or indirectly, is involved. Those of us who are directly involved are conscious of the privilege and joy that are a concomitant part of that responsibility. Especially can it be an exciting and rewarding experience to have a part in the training of young minds for the rapidly-evolving scientific age.

No one can deny the importance of science in the world today. Its impacts on our daily lives and thoughts are inescapable. But those of us who are close to science and the teaching of science may at times find our thoughts and actions so bound up with the details of our particular specialized areas that we neglect the wider implications of the unprecedented and rapid advances in scientific knowledge. Particularly are we prone to neglect the social implications which inevitably emerge as a result of our increasing mastery over the forces of nature.

There is expanding evidence that our technical skills and scientific knowledge are running far ahead of our social understanding. There is a growing conviction on the part of many of us that we are on the horns of a dilemma: one horn being our increasing faith in our ability to expand our scientific and technological horizons, the other being our mounting skepticism with regard to our ability to solve the resulting interpersonal and intergroup problems. Man's struggle with nature is, in general, making satisfactory progress: man's struggle with man is far from being resolved.

Scientific advances alone are not the answer, and education along narrow scientific lines is not enough even for those who may become our outstanding scientists. An understanding of the cultural, moral, social, political and economic implications of science is rapidly becoming one of the major needs in our population, among scientists as well as among non-scientists.

The augmented and urgent importance of social understanding is highlighted by the rapid increase in the world's population, with its accelerating consumption of energy; by the sudden availability of large sources of nuclear energy, with its dangers and emerging fears; by the conquest of disease and other hazards, with the consequent extension of life-span; by the improvement in machines and appliances, with the resulting tremendous increase in leisure time; and by the growing need for greater food production and a more equitable distribution of the food produced.

The recent survey by Margaret Mead and Rhoda Metraux on the

image of the scientist in the minds of high school students presents some disquieting conclusions, and should give us much food for thought. In general, the students' mental picture of the scientist is that of a cold unemotional brain: a cog in a machine. His work is dull, monotonous, uninteresting, tedious, time-consuming, and without adequate recompense or recognition. He does not know what is going on in the world. He has no social life. He does not kiss his wife. He can only talk, eat, breathe and sleep science.

What can be done to dispel the mistaken notions about scientists, to produce more well-trained scientists, and to improve the quality of education in general and especially of education in science and mathematics?

If we as scientists have been at fault in creating the unflattering impressions, it is up to us to make every effort to dispel them. We can let our students, and the public, see through our behavior that a scientific career can be an intensely human and rewarding experience. We can illustrate by our own actions that life can be lived to the full.

There is a wonder and a delight in studying the laws and forces of nature; a fascination in observing and understanding the world around us. And no greater reward can come to anyone than to discover a new law, or to formulate a new principle.

Let no one believe that preparation for a successful scientific career is easy. But neither is it easy for any other successful accomplishment. We must somehow develop a generation of students who are intellectually tough-minded: who will be willing to tackle intellectual problems and who will take a quiet pride in intellectual achievements.

We need quality in every area of education: in every field of endeavor. We need a broader general understanding of scientific methods and their implications, but we need equally a wider appreciation of the arts, the humanities, the social sciences, and the fundamental ideals of our culture. And we need these in every one of our citizens.

This is a high ideal, but we must make every effort to attain it. And the effort must be made at all levels, from the home and the community, through the schools and colleges, to the federal government itself.

In all areas of accomplishment there can be identified two great educational essentials for success at a high level. These are, first, the ability to use one's native language clearly and precisely, including a well-formed habit of reading widely and with comprehension; and second, a good grounding in mathematics. With these as a basis, it is possible to develop and acquire other desirable attributes. Among these are the ability to think independently, reflectively, and analytically; an awareness of the major social problems of mankind and the attempts that have been made at their solution; some knowledge of other languages and other cultures; and an appreciation of scientific methods and their implications.

A fear of mathematics sometimes deters students from entering upon a rigorous curriculum of studies. Yet the intrinsic beauty inherent

in the structuring and functioning of mathematics can appeal to everyone when the subject is properly presented. Beyond its value as a tool, it can and should provide fascination and enjoyment for everyone. And for the gifted student it can be one of the most stimulating experiences of his life.

We have long been accustomed to thinking of the United States as being preeminent in science. Now, suddenly, we are not so sure. The scientific challenge that has been thrown at us has been accepted by the American people, if popular interest and concern are any criteria. There seems to be general agreement that something must be done. The questions are, what to do and how to do it? No one person can furnish the answers, but if enough people are truly and actively concerned, significant answers will be formulated.

I believe that the most important objective to be realized (and it must be realized quickly) is to offer a higher quality of education than we are currently offering to the students who will be our future teachers, scientists, statesmen, and business and industrial leaders. The over-whelming claims on educational facilities and teachers' time, of the needs of the many high school students who will not go on to college have diluted the energies of the schools: energies which might otherwise be devoted to intellectual rigor and preparation for advanced study.

The dilution of quality has been especially acute in the teaching of science and mathematics. Industry and government have little if any difficulty in outbidding schools for the services of persons well trained in these fields.

The problem would be serious at any time, but it is dangerously so now, when we are on the verge of such vastly greater power over the forces of nature than we have ever before held. It is dramatically apparent that we are entering upon a scientific revolution: a revolution of which atomic fission and fusion, and the exploration of space, are only symbols. The power of atomic fusion is beyond any power we have ever known, and has implications which stagger the imagination. The speed and range of the rockets which launch satellites put to shame our accomplishments with airplanes, and open whole new intellectual vistas.

Experiments which were inconceivable a very few years ago are now being productively conducted in such fields as genetics, biochemistry, neurophysiology and pharmacology. Many of the long-hidden secrets of life are tantalizingly almost within our grasp.

We cannot escape this scientific revolution. And we must not meet it with fear or despair. We must prepare ourselves as intelligently as possible to take full advantage of the surge of scientific developments of which the first wave is already upon us. This can mean only the maintenance and the improvement of our scientific status with respect to the rest of the world. The basis for the improvement must be the increase of quality throughout our entire educational system.

There appears to be a tendency, under the fear of sputniks and other indications that we are not as far ahead as we once thought, to

feel that we can simply purchase scientific eminence if we just spend the money. Increased funds are indeed a most important necessity if we are to realize our full potential in world leadership, but money is only one part of the problem, and science is only one phase of the picture.

If our citizens of tomorrow are to realize the benefits of the scientific revolution, and, indeed, to contribute significantly to these benefits, we must provide quality in education in all fields, including some understanding of scientific methods, for our future statesmen, lawyers, physicians, teachers, engineers, and business and industrial workers, as well as scientists. We need quality in every single job that is done, and we need in everyone some understanding of scientific methods and their implications. Only in this way can people be prepared to deal wisely with the benefits, the problems, and the dangers of the rapid advances of science.

By the time this paper appears, we of the American Association for the Advancement of Science will have held in Washington a parliament of science, consisting of leading scientists from all parts of the country and from all fields of science, and of members of the Congress. It is hoped that from this parliament may come significant recommendations for strengthening education in our country, and for means of preparing ourselves for the urgent problems posed by the revolutionary developments just ahead. Congress now has before it two major bills along this line, S 3163 and S 3187, and a host of minor bills. Each proposes the spending of large amounts of money; more than two billion dollars in one instance.

The wise expenditure of money can accomplish much, but even this cannot accomplish all we need. The unwise and ill-conceived use of money may well do more harm than good.

Beneficial results may reasonably be expected by breaking the existing, fairly rigid salary schedules so that teachers of high merit are paid high salaries and teachers of ordinary merit are paid ordinary salaries. More can be accomplished in raising the status of teaching and in setting desirable goals for prospective teachers by increasing substantially the salaries of the better teachers than by giving minimum increases to all.

Beneficial results may also be expected from providing more scholarships for encouraging and rewarding scholastic achievements of high quality. Such scholarships should be based on competence and ability in English, mathematics and perhaps a modern foreign language. Recipients should be allowed to choose freely their own fields of specialization. In offering such scholarships, no attempt should be made to purchase interests that have not developed naturally and that may not be permanent.

We should do everything in our power to increase the status and remuneration of scientists and science teachers, but we must give comparable status and remuneration to teachers in other fields, and above all, we must not try to buy spurious interests in science.

One way to avoid the pitfall mentioned above is to strengthen the testing, counseling and guidance programs of the schools of the nation, and to improve the quality of counseling personnel. In this way it might well be possible to avoid the necessity of the same school having to teach students of widely divergent interests, abilities, and later educational and career plans. Too often the burden of a diversity of responsibilities falls on a single teacher, and under such circumstances it is only natural that much of the teaching is pitched at the level of the average student. Guidance counselors can overcome some of these difficulties by helping students to plan appropriate curricula in line with their individual abilities and interests.

It is highly likely that Congress will appropriate large sums of money for education during this session. If the money can be spent wisely, free from motives of fear or despair, we may hope to attain desirable goals. One of the bills now before Congress has among its avowed purposes to "assure the intellectual preeminence of the United States. It is to be hoped that this noble objective will be achieved.

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CALL TO CONVENTION

1958 is a year of biennial general meeting of Phi Sigma, as specified in the constitution. Exact time and place have not yet been set. Tentatively, choice is now between early September (just before classes resume) or during Christmas vacation. As a safeguard, a delegate and alternate should be elected at a business meeting this spring and their names and addresses forwarded to the Executive-Secretary-Treasurer, Dr. Fred Orcutt.

The Chapters of Phi Sigma are responsible for seeing to it that items which concern them are included on the agenda of the biennial meeting. They are also responsible for instructing their delegates in the matters which the Council will refer to the Chapters for consideration prior to the assembly.

The national treasury defrays transportation costs of the delegate from each chapter. Most local chapters meet the lodging and subsistence expenses of their representatives.

Karl F. Lagler
National President

REACTIVATION OF PI CHAPTER, EMORY UNIVERSITY

Under the guidance and leadership of Dr. Woolford B. Baker, Mr. William E. Brillhart, and Dr. Chauncey G. Goodchild, the Pi Chapter of Phi Sigma Society has been reactivated after three years of inactivation.

At the last meeting, 3 February 1958, the following were initiated into the Society:

William Roger Bartholomew	Bernhard Paul Meinhardt
Mrs. Billie Ruth Bird	Diane M. Oakerson
Allen Jerome Blass	Robert A. Pedigo
Thomas W. Brooks, III	Barbara Ann Powell
Michael Collins	Lynn Raulerson
Herbert L. Davis, Jr.	Jack B. Sartain
W. Donald Fattig	Elbert W. Schmitt, Jr.
Herbert Barclay Goodman	Henry Kenneth Walker
Michael W. Harkey	William Michael Watterson
Jeanne H. Matthews	David J. Cotter

At the same meeting the following officers were elected: Pres., Robert Pedigo, Biology Dept.; Vice Pres., Henry Kenneth Walker, Box 822; Rec. Sec., Diane M. Oakerson, Biology Dept.; (Editor) Corr. Sec., Herbert Barclay Goodman, Box 166; Treas., William W. Brooks, III, Sigma Chi House; Faculty Advisor, Dr. Anthony C. Clement, Biology Dept.; and Council Representative, Dr. W. B. Baker, Biology Dept.

Following the elections Dr. Robert Platt of the Biology Dept. presented a very interesting address, "Graduate Schools and A Career in Biology."

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PHI SIGMA AND THE PRESIDENCY OF THE
UNIVERSITY OF WISCONSIN

In February, 1958, came the announcement that Dr. Conrad A. Elvehjem had accepted the post of President of the University of Wisconsin at Madison, Wisconsin. This happy event marks the third president of this illustrious university who has been active in the affairs of Zeta Chapter. Dr. Elvehjem and his predecessors in office, Dr. E. B. Fred and the late Dr. E. A. Birge are all Zeta men. Phi Sigma is justly proud of this honor and of the record of these presidents in biological research.

THE EFFECTS OF THIRTY YEARS OF "PROGRESS" ON THE HURON RIVER IN MICHIGAN

by Henry van der Schalie

In 1930, as a student in graduate work at the University of Michigan, it was possible for me to make a survey of the ecology and distribution of the fresh-water mussels of the Huron River*, an attractive stream that flows through Ann Arbor. In that period, a little over a generation ago, it was quite evident that social and industrial developments would bring about so many changes that the fresh-water fauna would suffer considerably. Even at that time there were power dams at Flat Rock, French Landing, above Rawsonville, Ypsilanti, Geddes below Ann Arbor, Argo at Ann Arbor and Barton above the city. Not only were such dams obstacles to fish migration but they also brought about such drastic changes in the ecology of many of the species that inhabited the lower reaches of the river as to alter the original fauna completely. With the exception of the dam at Milford, the river above Ann Arbor was otherwise relatively free of major installations developed by humans. While originally it was thought advisable to plan another survey of the fauna in the river to understand better the changes that came about with time, several unexpected developments damaged the fauna to such an extent as to make the undertaking almost futile and somewhat unrewarding. While this stream is only another example of the kinds of changes that are taking place, it would be timely to indicate some of the known developments that affected this stream during the past thirty years.

In the late thirties, E. B. Williamson, while collecting dragon flies, came across a large pile of mussel shells along the banks of the Huron near the Delhi rapids. He called it to my attention so I took occasion to look into the situation. It seems that some venturesome people decided they would collect the mussels to obtain the pearls they produced. It was interesting to find that the species they took were mainly the pink warty-back, *Cyclonaias tuberculata* Raf. That mussel has a very extensive interidental plate and is often so heavily parasitized with flukes as to yield a high production of pearls. Unfortunately, the nacreous shell of that species is inferior both because it is not lustrous but dull and also because it tends to have an undesirable bluish color. It was clear that several tons of mussels had been sacrificed to obtain a small quantity of very inferior pearls. The whole operation was

*The Naiad Fauna of the Huron River, in Southeastern Michigan.
Univ. Mich. Mus. Zool., Misc. Pub. 40: 1-83, 1938.

wasteful but in view of the developments that will be cited later it was evident that this damage was minor in terms of the events that followed. Others have had ideas about becoming rich by recovering pearls from mussels. While the possibility is there, those so bent are usually not able to perform the tasks involved in such an undertaking; they certainly are unaware that it took Mr. Mikimoto a lifetime to produce pearls artificially in Japan.

The Huron, like many other streams in Michigan, was reasonably productive until about the time of the second World War. Most of us were so busy with war work that we hardly realized what was happening in the out-of-doors. The rapidity of the change was impressed on me when at a staff lunch in the Zoology Department I was asked where the Natural History class could best see a good bed of mussels. It was suggested to the instructor that if he would take his class to the shoals and rapids at Delhi, about 6 miles above Ann Arbor, he could show the class a fine bed of mussels and that at that station there would not only be many individuals but the shoals would yield 15 species representing 12 genera. It was somewhat surprising to learn at the next staff lunch a week later that none of the class was able to find a single mussel! Evidently something drastic has taken place.

During the war many tons of old rags were used for wiping machines in the Detroit area. These greasy clothes were loaded on trucks and taken to a laundry at Dexter about two miles above Delhi on the river. In the process of the laundering, the sewage disposal plant at Dexter carried about as much effluent in one day as it usually carried in a month. As a consequence, the wastes from the laundry might just as well have been dumped into the river directly. That single plant in its operation for a couple of years during the war practically wiped out all of the mussels and the aquatic operculates in the Huron River below Dexter. Another development in that same stretch of river bears comment. The Huron River, together with the Clinton River (to the north), has for many years been considered a park area and has been under the jurisdiction of Huron-Clinton Park Authority. Yet, some time after the last war a large automotive-parts factory was built right on the river and in the heart of this parkway at Scio about 2 miles below Dexter. The justification for the presence of that commercial plant in the middle of a so-called recreational area has, as yet, never been explained.

It is clear from the foregoing that the Huron River from Dexter to its mouth (a distance by river of about 60 miles) is hardly, even to a small degree, anything like the productive stream it was formerly. What of its condition farther upstream? In 1944, while gas rationing was still in effect, it was my good fortune to be permitted to collect in southern Michigan and in much of the Huron drainage to obtain Amnicolid snails which were to be tested by Dr. Stunkard and his students as possible carriers of the Oriental Blood Fluke (*Schistosoma japonicum*). Dogs which had been loaned to the Armed Forces in the Orient were being returned to their owners in the states and some of them had been infected; also, soldiers were returning who had been exposed to

schistosomiasis in the Philippines. However, this program of supplying possible intermediate host snails permitted survey work which would otherwise not have been possible. I shall never forget the day I visited some shoals in the Huron below Milford. In spite of all my efforts I just could not find the mollusks that used to be there. As I came up out of the river I found an older woman on a bridge waiting while two of her youngsters were swimming. I explained that I used to get a wealth of shells from the river but was disappointed to find they were not there any more. It was then that I learned that a war factory at Milford had grossly polluted that area and for a year or two no one could swim in the river! Some time later when I tried to find Pleurocerids in the lake-like expanses of the river many miles below Milford it was evident that the bottom fauna of the stream had been irreparably ruined for long distances below Milford. Since that time the stream has become more sanitary, perhaps in part due to the development of a very large park and swimming facility built when a large pond was created by a dam near the junction of M-16 (the Detroit-Lansing road) with the river. This region is called Kent Lake and serves as a retreat during the summer months for thousands of people from the Detroit area.

Within a generation of time this local river has changed from a very productive stream with many natural resources to one that is mediocre at best.* Most of the original fauna has been altered and only certain tolerant forms have survived. This development is unfortunate because when we know the original fauna of such a river it is possible to learn something about former stream confluences and the relations of these rivers to one another in the early post-glacial stages of development.** It is also discouraging when such changes take place in the vicinity of an institution provided with facilities for the study of a wide variety of biological fields. For example, Dr. George R. LaRue once stated that just one mollusk species in the river, *Goniobasis livescens* Menke, yielded enough varieties of cercariae to keep all of his students working on life histories for the rest of their lives. As an operculate, gill-breathing mollusk, that snail is now difficult to find in the river. In this connection, it has been of interest to note the shifts that have taken place ecologically. Many pleurocerids, such as *Goniobasis livescens*, live on gravel and rocks in the stream. After the river had been badly polluted, the rocks and bottom became covered with a thick, slimy algal film and the snails that formerly lived on clean rocks in clear water disappeared. But there is an

*The late H. J. Van Cleave published an excellent article: "Man Meddles with Nature" (Scientific Monthly, 40: 339-348, 1935) indicating some of the harmful effects of meddling.

**The Value of Mussel Distribution in Tracing Stream Confluence. Mich. Acad. Sci. Arts & Letters, 30: 373, 1944.

"ersatz" mollusk fauna which is represented by aquatic pulmonates such as the pollution tolerant *Physa* and *Helisoma*. While they were formerly not common in the river they are now almost everywhere in slow-moving waters.

These observations regarding some of the changes in this particular river are perhaps not as drastic as some alterations in many other streams. The late Bernard DeVoto (Harpers, 1955: 16) in an article with the title, "Hell's Half Acre, Mass.", has treated the subject of changes that come about through urbanization, etc. He has expressed this process nicely in the following statement:

"Go anywhere you choose. See the suburbs and shopping centers spreading into the fields. See expressways carving up open areas whose loveliness and quiet are indispensable and are also ended forever. Pick up any newspaper and read what is happening everywhere. For everywhere natural areas, semi-natural areas, and wholesomely disregarded areas in a partially natural state, are being obliterated. The growth of towns, cities, and industries is swallowing them up. No end to this process can be imagined, and it is irreversible."

In conclusion, it may be added that those who have had the experience of working in regions that have been unscarred and are relatively well supplied with their original fauna and flora are indeed fortunate. While it is important to understand the mechanism of evolution as it is revealed through studies with the standard laboratory animals, the tests of its full meaning and significance can only be valid when those principles can be applied to the myriad of animals and plants in nature.

* * * * *

DR. ORCUTT NAMED HEAD OF BIOLOGY AT V.P.I.

Dr. Frederic S. Orcutt, professor of bacteriology at Virginia Tech, was named acting head of the biology department in a statement issued jointly by L. B. Dietrick, dean of agriculture, and Dr. G. Burke Johnston, dean of applied science and business administration. The department has work in both schools.

The appointment of Dr. Orcutt as acting head became effective Feb. 1. Dr. Orcutt joined the Virginia Tech staff in 1936. He has B.S., M.S., and Ph.D. degrees from the University of Wisconsin. In Phi Sigma, Dr. Orcutt is the Executive Secretary-Treasurer of The National Organization.

GENERAL EDUCATION BIOLOGY

Harold A. Cahn
Department of Biology
University of Colorado

The most characteristic aspect of the controversy about general education is confusion. There is confusion as to whether general education is even a proper function of the undergraduate school. More important, there is confusion about the real aims of education itself, say nothing of general education. If we may assume that it has a place on the college level, we must ask what it is trying to accomplish and what is needed to bring these aims to fruition.

Both of these questions are central to general science education in particular. It is well known that a school can not present an effective engineering program without a large outlay of funds for advanced equipment and specially trained teachers. Yet it is thought that no special preparation is needed to set up a "general science" course in biology or physics. One need only turn the slightly odious task over to a regular (preferably junior) member of the faculty, give him a classroom, maybe a salary boost and the job is done! Perhaps the fastest way to kill the value of real general education is to do just that! What would the specialist do when faced with a rather recalcitrant group of freshmen in a course labelled "Biology and Life"? Of course he would do the same as any of us; namely, that for which his training and personal inclinations prepared him. Certainly the factual material of biology would be presented in abundance. Training of the mind (whatever that often overworked phrase may mean) would not be forgotten; for are there not difficult plant life histories to learn and a phraseology to go with them which is the pride of all science? But are these the things which are most significant in the general education of a man?

Let us look carefully, albeit briefly, at what general education can and should do. Some years ago Robert Maynard Hutchins, in a provocative little book, *The Higher Learning in America*, stated clearly what a college (or university) should not do. He also gave cogent reasons why certain things are the function of genuine higher learning and why certain other things are not.¹ Hutchins finally declared that specialized

¹ Among the things claimed by Hutchins not to be proper functions of the higher learning are body building, character building, professional "trade secrets", the genteel arts, homemaking or how to make money. Behind the twentieth century and its manifold confusions, if not neuroses, lies a tradition in which men thought about, formulated and solved the central problems of humanity. By a knowledge of this tradition, Hutchins claims, one becomes emancipated from the mythology of his own time. This emancipation, along with the responsibilities which it entails, constitutes the mark of a genuinely educated man.

training (in the sense of learning principles, not tricks) and the search for truth (quite independent of application) are the only two legitimate aims of higher education. These two aims are not mutually exclusive although since we are so strong on compartmentalization it is perhaps best to treat them as such. We leave specialized training to the individual academic departments in the belief that the psychologist, let us say, knows best what a student of psychology ought to study in the way of psychological principles. What, then, about the search for truth? It appears to be characteristic of modern American civilization that "workability" has been substituted for "truth". Workability brought us the jet airplane, two cars for many families and the atomic bomb. It also brings an unparalleled pace of life and a false worship of the expert. Even small children today have little chance to know the joy of creativity involving simple things, a home made tree house or creations of the paste pot and scissors.² Their time is taken with TV and organized activities designed to accelerate the process of "growing up". This state of affairs is symptomatic of an age when we think that problems not solvable by science are not problems at all. If, perchance, we see something wrong in this view, there is hardly time to formulate another.

Truth is within us, it is a state of being. This we have been told by religious men from time immemorial. If this is so, then education must abdicate the search for Truth in favor of a less lofty aim. Shall we substitute for Truth the words "truths of mankind"? What are these truths? They are the *alternative answers given by mankind to great philosophical problems*. The philosophical problems are: What are we? In what relationship do we stand to reality? What is reality? What is knowledge? Sophisticates tell us that the search for answers here is outworn for it is not possible to give final solutions. A little reflection shows that this is the wrong emphasis. First of all, solution of a central problem need not provide absolute answers valid for all time; rather what we want is a "Weltanschauung" which is genuinely meaningful for a given time. Civilization in the high sense results from the expression socially of an internalized philosophy; without it at best there is technology and at worst anarchy. Secondly, human beings are incurably philosophical. The person who sees nothing in the philosophical quest of mankind is something less than human. Even though absolute Truth may be eternal and immutable (also ineffable), the truths of mankind grow senile with time and must be freshly formulated. It is this which gives us a significant principle for higher education. Paraphrasing Hutchins, I repeat that *education worthy of the name is the process by which we become cognizant of the truths of*

² Need it be mentioned that the virtue of "simple things" for either children or adults is that they force reliance upon inner creativity rather than upon the mere outward acceptance of that which has to result from the mythology of the age.

*mankind and through this cognizance reformulate in meaningful terms a philosophy for our own age.*³

Pure and applied science in the twentieth century have provided the greatest field for philosophical reconstruction and development of new ideas in our time. We need only examine the impact of such major concepts as that of evolution, relativity and psychoanalysis to realize their fertilizing influence on philosophy, literature and even religion. In spite of this, it is suggestive that often those who study and practice the sciences are the least likely to have any critical view of the wider implications of their own work. They are provided with no perspective, as it were, from which to view science both as a search for truth within the scientific framework and as a human activity outside of that mold. The teachers of today are the students of yesterday; it is little wonder that many of them (there are some brilliant exceptions) can do little more than present a survey of the facts of some scientific field in the name of a general education course. It is my contention that the very limitations implicit in specialized scientific training are reflected even in faculty meetings where the question of general science education is raised.

If, as herein implied, scientists are not generally good teachers for terminal courses for non-science students, who is prepared to do it? The answer here depends upon what we think should constitute such courses. To this we now turn.

I would formulate the aims of general education courses, in the sciences or otherwise, as follows:

1. To search out, examine and evaluate critically the major principles of the field under study. This includes both principles discovered by research in the field and those by which an investigator is guided in his work.
2. To compare the principles mentioned above with those of similar rank in other fields. This examination may be partly historical and partly purely analytical.
3. To try to erect a "platform of evaluation" from which the field under study can be scrutinized as an example of one human way to approach truth.

These points form a sort of natural hierarchy through which one can progress from consideration of fairly specific detail to the broadest kind of philosophic and humanistic inquiry. I should like to apply these criteria to an hypothetical course in the biological sciences.

³A synthetic philosophy manufactured by the "craftsmen of syllogisms" usually does not answer to the basic need. Rather it is the making explicit and consistent the finest elements of the spirit of the age which can "take ahold" of the time. This can never result, either, from a "consensus genitum"; it is those who are intellectually creative that can formulate the broad outlines which are then clothed by the movement of history.

It is obvious that a student untutored in biology would not gain any great appreciation of, say, the "law" of biogenesis without some factual detail to exemplify that principle. There should be some consideration of homologies and analogies in a given evolutionary series and a comparison of early embryonic stages from various animal phyla. In presenting this background material, two important methodological considerations appear:

1. The reason for introducing any specific biological detail is because it is necessary (or useful) to exemplify a general principle.
2. By a rather strict adherence to the above criterion, it should be found that much of the salient factual material of biology will have to be presented but that there will be little temptation to introduce material simply because it has a time honored place in regular biological training.

One reason that students tend to forget much factual material that is often presented in college, is because the facts are unrelated to principles which are of genuine use to him.⁴ It turns out, however, that the major principles of biology are of real use to an educated man because they play a role in the thinking of the times. Of course some factual material is interesting for its own sake (any of us might be fascinated to know about ants which herd and milk aphids) and other factual material is necessary because it does illustrate a principle.⁵ The trouble is that there are libraries of facts and only a few well formulated principles in biology. It is much too easy to stress the facts with the misguided thought that any intelligent student will "see" the principles.

Biologists may disagree upon what are the most important principles of their field. The following are examples of the kind of things which, because of their wide spread implications, I would call principles:

1. A living system is a physico-chemical open system existing in a state of ultrastability with properties quantitatively but not qualitatively different from inanimate systems.
2. The basic plan of a living system is laid down in its genetic constitution; its survival in time is assured through the phenomenon of reproduction in the organic continuity of the germ plasm.

⁴Here we must avoid a narrow interpretation of the word use. Mere vocational use is, of course, quite limited. For a genuinely educated man, use may apply equally well to the intellectual life as to the work-a-day vocational world.

⁵I specifically disavow the thesis that factual learning is good because it provides "mental discipline". Memorizing facts may be good discipline but there is little indication that this discipline can be transferred to where it may be needed. Furthermore, there is fully as much discipline in trying to grasp abstract ideas as there is in learning facts.

3. The rise of life from non-living material involves evolution at various levels; the stellar evolution of atomic species, the primordial terrestrial evolution of molecular entities and the coacervate level of the production of protoplasm from its basic constituents.

These are the fruit of biological research; attention to them constitutes the first part of the first aim of the course. Next attention may be turned to the principles by which the researcher is guided. These principles are the operational rules of science; they constitute the scientific method. The detailed study of the methodology of science is properly a topic in the philosophy of science. Few students are exposed to this subject except tangentially. For this reason there is room for more than a cursory glance at this subject in general education. There are two kinds of questions which arise in connection with examination of the scientific method. Of what does the method consist? Here it is necessary to explain the meaning of such terms as fact, observation, hypothesis, theory, law, verification, induction and deduction. These words have very exact meanings (often not apparent to the layman or even many scientists) and are packed with philosophical implications. Once we are "given" the scientific method a second set of questions arise. The very fact that there is a method implies that there may be other ways of solving problems about the physical world. What, then, justifies the method of science as in contrast to other methods? To answer this question, we must penetrate to the heart of problems in metaphysics and epistemology. Is there an objective world, how can we have knowledge of this world, what must we assume about the nature of this world in order to have a scientific method; all of these are typical problems which one must face in attempting to understand science. Are these questions too esoteric - too impractical? It is interesting that the discoveries in the most advanced sciences have forced both scientists and philosophers to reopen some of these "outworn" philosophical queries. Indeed, much of the froth of the mid-century ferment in science surrounds these questions. This is reason enough to introduce students to these things. It is also suggested that examination of basic problems tends to rip apart the well settled furrows of a mind ensconced in a complacent philosophy, a disease quite rampant among our students.

Biology as a field differs from chemistry and physics largely in that it is more observational and inductive in its approach. Historically, any science starts with observations and works through the inductive generalization stage to the theoretico-deductive level. It is therefore instructive to illustrate the mode of theory formation in biology and compare it to that in the more advanced sciences. The development of genetics from the stage of observations about the breeding of domestic animals to recent attempts to "decode" the sequence of nitrogen bases in the DNA molecule as the carrier of hereditary information, illustrates methods of theory formation on at least

two, and maybe three, levels. Classical atomic theory and non-relativistic mechanics afford interesting comparisons. One outcome of such comparisons would be to show the student how specialization can lead even the gifted investigator to believe that the mode of theory formation in *his* science is the only valid way for science in general.⁶ Also such comparisons provide the opportunity to analyze the effect of the general world view upon scientific theorizing as seen in an historical context.

The final aim of our hypothetical course is to try to erect what I have called a "platform of evaluation" from which to judge biology as one way to understand the world of living things. This is the most difficult and abstract, but also the most meaningful phase of the course because through efforts of this kind the students begin to feel the emancipation of the intellect mentioned earlier.

One could conveniently start erecting the "platform" by a consideration of the humanistic implications of the theory of evolution. Biologically speaking, the factual information about the theory should already have been presented. At this stage it is not asking the students too much to demand a more sophisticated treatment of the theory in relation to culture in general. Can it be extended into sociology, political science, literary criticism or theory of religious history? Yea saying or nay saying to these questions depends largely upon whether one agrees with the basic presuppositions of science as valid within the fields mentioned.⁷ If it is possible to formulate a view which allows for other (or even opposed) approaches to these problems, a conflict may arise. Pedagogically speaking, for the student it is a first rate intellectual experience to discover that one may hold a different set of basic premises and that a method of inquiry based upon such assumptions need be no less inconsistent than scientific method. To illustrate this point it might be instructive to contrast the scientific world view with one or more sharply different approaches.⁸

We, and our hypothetical students, have now finished an academic year. The student has examined a fair range of factual biological data

⁶ Much of the difficulty which arises as to whether economics or sociology are "true" sciences stems from a misunderstanding about the stages and parts of the scientific method. Similarly, the scientist that argues that theory formation must start with empirically given facts shows a lack of understanding of the genesis of theories by deduction from the contentless propositions of pure mathematics.

⁷ Arthur Pap and others in the logical empiricism movement have insisted that it is unfair to evaluate science as if it were based upon certain untestable metaphysical assertions. It appears to this author that a sophisticated case of "weasel wording" is involved in either the assertion that (a) the premises of science are purely operational, or (b) if the premises are metaphysical they are not both necessary and sufficient to science. The point is that there must be untestable *beliefs* about the world and methodology for *human* scientists to operate at all. Science without scientists is an empty abstraction.

⁸ I would favor contrasting the objective mechanism of nineteenth century science to the twentieth century logical empirical view of science on the one hand and both to the so called subjective experiential philosophy so characteristic of the thought of India for many centuries on the other.

and has been exposed, at least, to various kinds of principles at various levels. He may be left with the rather empty feeling that there are many roads leading in various directions but no sign-posts pointing to the truth. What, then, has transpired? I should like to close this paper with a consideration of the positive "goods" which should come from a course of this kind and, finally, to a word about the kind of teacher who can make good on the "goods".

It has been said that without humility nothing creative nor genuinely intellectual can be achieved. To find that a viewpoint one holds is but one which can be contrasted to others, is to get a lesson in humility. To further find that there are no ready made criteria by which one can "rank order" philosophies in order of merit, is to engender a questioning attitude. Finally, to see that history itself can be envisioned as a series of experiments, as it were, in which man tries *and fails* to find a perfectly adequate philosophy is to bring about a state of mind conducive to genuine intellectual searching. This, as we have said, constitutes the aim of higher education. In a lesser way the fruit of the course is precisely to give a view of biology which permits the student to evaluate it as a human enterprise and to understand its relations to other activities. This too is said to be an aim of education - even of "general science" education. Finally, the student should come out with an enlivened appreciation of the world of living things which, in itself, is an esthetic "good".

It should now be quite clear why the scientific specialist would seldom be a suitable teacher for the kind of course outlined in this paper. To be a competent specialist demands a life time of study in a given field for such is the state of technical science today. What is really needed is the specialist in generalizing! On the content level this means a man who has something more than a rudimentary knowledge of the sciences (from mathematics to psychical research), some background in history and a lively understanding of philosophic principles. But content is not enough, for all of this is available in a collection of textbooks. I envision the ideal teacher of general education as one who can readily "shift gears" from one way of thinking to another and who has enough humility to affirm the affirmative and negate the negative (that which shows that other views are wrong) of any philosophy. Finally, in the jargon of the educationalists, our paragon of a teacher must be able to "challenge" students; this means that his own enthusiasm for the subject and its worth must be so great that it infects even the students. Indeed, such a teacher would be an exemplar of a "platform of evaluation" from which any man could view his world without losing his individuality or getting ulcers.

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THE ASSOCIATION OF COLLEGE HONOR SOCIETIES
AND SCHOLARSHIP TODAY

The following resolutions were unanimously endorsed by delegates of member societies at the 1958 annual convention of the ACHS. This convention was held at Allerton House of the University of Illinois, March 1, 1958. Phi Sigma was represented by its National President, Dr. Karl F. Lagler.

"The Association of College Honor Societies, meeting in its 1958 annual convention, reaffirms the purposes to which it is dedicated, embracing the maintenance of high scholastic and educational standards in colleges and universities. At the threshold of the Space Era, and in recognition of the singularly vital part that superior scholars play in national security, the Association expresses concern in the inadequacy of the preparation offered by secondary schools whose students its member societies seek ultimately to honor. It urges that American educators at all levels - parents, professional teachers, and administrators - unite to accelerate maturation of currently reborn goals in the re-evaluation and re-direction of the philosophy, aims, methods, and curricula of our educational system. To these goals the Association of College Honor Societies gives its resolved endorsement."

"The Association further resolves that the present tendency to *spend* the American nation into a superior educational system lacks sound foundation and should, therefore, be examined critically, rather than be pursued blindly."

"It is further resolved that the Association commend those educators, particularly in secondary schools, who strive with renewed means to achieve high motivation in the learning process, who encourage scholastic pride and accomplishment by honoring classroom attainments, who will not countenance automatic advancement of students irrespective of the character of their classroom performance, who will, in fact, help to instill a different sense of values in the population at large - a set of values that will generate admiration rather than disdain for the individual who possesses special aptitudes important for society and who cultivates them with intensity and purpose."

"It is further resolved that the Association do everything within its power leading to coordination among primary, secondary, technical, collegiate, and graduate schools locally, nationally, and internationally. As our opening speaker pointed out, it is astounding that our educational scene since 1900 should have witnessed two strikingly contrary developments - the strengthening of our graduate schools at our great universities and the decline, the retrogression of our secondary schools. If the secondary schools can be made more completely effective in promoting scholarship, the four-year colleges will be able to perform a far more effective service to the nation and the entire fabric of our educational system will be improved."

ALPHA LAMBDA CHAPTER CELEBRATES ITS TWENTY-FIFTH ANNIVERSARY

The academic year 1957-58 marks the twenty-fifth anniversary of Alpha Lambda Chapter of Phi Sigma. The chapter was installed at the University of Utah on February 13, 1932. For several years prior to this a biology club known as Pi Zeta Phi had been functioning which petitioned the national society for affiliation. The installation was conducted by the National Chancellor, Dr. Paul B. Sears, then of the Botany Department at the University of Oklahoma. In this day of concern about the training of scientists, it is interesting to recall that in his charge to the new chapter the Chancellor emphasized "the importance of discovering and encouraging those gifted with genuine scientific curiosity as well as the need for continued intellectual criticism" [Biologist, 1932, 13(3):39-40]. Dr. Sears was assisted by doctors Margaret Schell and Howard E. Dorst, as sponsors of the new chapter.

The officers of the new chapter were William H. Behle, President; Olive Thomas, Vice-President; Lowell Woodbury, Secretary; and Florence Jones, Treasurer. The twenty-two initiates and charter members were as follows, those marked with an asterisk being faculty members: William H. Behle, Aleen F. Berlin, Elmer G. Berry, Richard W. Bush, Ralph V. Chamberlin*, Walter P. Cottam*, Frank P. Giles, Ralph F. Hill, Maynard S. Johnson*, Florence B. Jones, David C. Larson, Edward W. Lowrance, Dorothy Naylor, W. W. Newby*, Frances A. Raley, Don M. Rees*, Lucile A. Rice*, Ira R. Telford, Kathryn E. Thomas, Olive Thomas, Kenneth L. Ward, Lowell A. Woodbury.

Through the years the chapter has flourished. The roster of members now numbers 432. Usually the calendar of events has involved monthly meetings with guest speakers, fall and spring canyon outings and an annual initiation banquet. Occasionally there have been special projects like a newsletter during the war years, open house accompanied by exhibits in the various fields of biology or tours of particular departments and facilities. The actual celebration of the Twenty-fifth anniversary was at a banquet held on December 2, 1957. This was a joint affair also honoring Dr. Ralph V. Chamberlin, who was the Head of the Department of Biology when the chapter was organized. The present officers of the chapter are Donald B. McDonald, President; Robert Warnock, Vice-President; M. Raymond Lee, Secretary-Treasurer. William H. Behle is faculty sponsor and Council Representative. The initiates for the current academic year are: Clifford H. Anderson, Norman V. Chamberlain, Ted Davis, Jr., Robert J. Deitz, Jerald D. Jensen, Joseph W. Lepak, Jay Linam, Steele R. Lunt, Kazutoshi Mayeda, Guy G. Musser, Irma S. Radcliffe, Joann Sessions, Gerald R. Smith, Marion W. Sorenson, Wayne S. Zundell.



Officers of Alpha Lambda Chapter and honored guest.

Left to right, Donald McDonald, President; William H. Behle, Chapter Sponsor and Representative on National Council; Dr. R. V. Chamberlin; Robert Warnock, Vice-President; and M. Raymond Lee, Secretary-Treasurer. December 2, 1957, 25th anniversary banquet.

RALPH VARY CHAMBERLIN:

EDUCATIONAL AND CULTURAL CONTRIBUTIONS*

By

Angus M. and Grace A. Woodbury

Great though the scientific achievements of Ralph Vary Chamberlin may be, his educational and cultural contributions are not necessarily dwarfed thereby. It has been well-said that praise is a debt we owe to the achievement of others. It is no flattery to reward such accomplishment with a suitable award of honor, for proper praise brings out the best in a man just as unwarranted or unjust criticism may stifle the desire to excel.

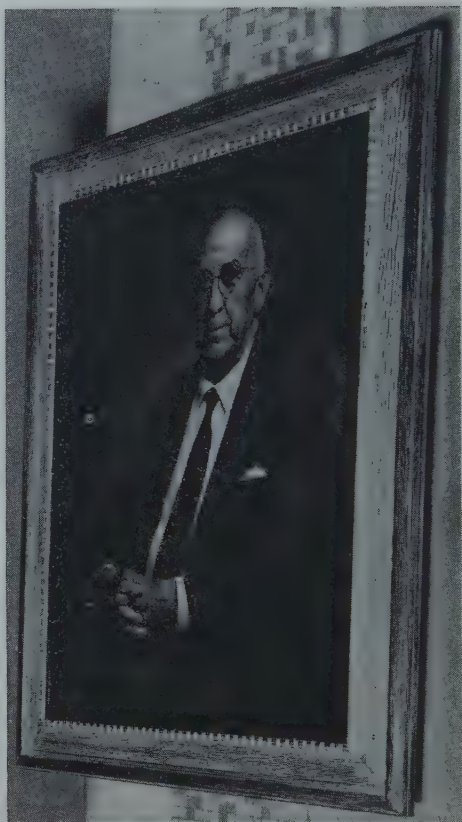
All down through human history, the struggle to attain intelligent understanding has been hampered by ignorance, superstition, prejudice and illogical thinking. Tonight we honor a man who has maintained throughout his life high standards of clear thinking guided by the scientific method in which the results of common sense are supplemented by careful observation and controlled experimentation. This scientific approach to evaluation of knowledge, like a beacon light penetrating the darkness of night has helped to illuminate the mental fogs of the past and has done much to help in the incessant struggle to unseat ignorance, banish superstition and alleviate prejudice by helping to expand the boundaries of accurate tested knowledge.

His brilliance in scientific fields has been radiated into adjacent educational and cultural circles wherever he has been active, but such radiance has not always been well received because setting too good an example is a kind of performance not easily forgiven. He was in a sense a scientific pioneer bringing his tested knowledge into a field where science had not previously been popular, but wherever he has gone, he has lighted a flame, a beacon to his students who thirst for knowledge.

His educational contributions at this university have been well documented in his book published in 1950 "Life Sciences at the University

*Alpha Lambda Chapter Honors Dr. R. V. Chamberlin

At the 25th anniversary banquet of Alpha Lambda Chapter held on December 2, 1957, tribute was paid to the man who more than anyone else built up the biology program at the University of Utah. At this time a portrait of him by Alvin L. Gittins was unveiled and presented to the University. A book of letters from colleagues, students and friends was presented to him. The following two papers were read summarizing his contributions. Dr. Chamberlin is one of two honorary members of the Alpha Lambda Chapter of Phi Sigma and the only living one. This honor was given him in 1946. An honorary ScD. degree was bestowed on Dr. Chamberlin by the University of Utah in 1942.



Dr. Ralph Vary Chamberlin, honored at Alpha Lambda Chapter 25th anniversary banquet, with his portrait by Alvin L. Gittins which was unveiled at this time and presented to the University of Utah. University of Utah Union, December 2, 1957.

of Utah," in which the biological activities are well portrayed in historical perspective. As background for understanding his part in these historical events, it seems fitting to review briefly the high lights of his life.

Ralph was born at Salt Lake City, January 3, 1879. He became immersed in the natural history of his surroundings and he proved to be a brilliant student in the schools he attended. At age 19 in 1898, he obtained a BS degree at the University of Utah on the old campus at the present site of West High School in Salt Lake City. From 1898 to 1902, he was a school teacher in the old LDS (Latter Day Saints) College in Salt Lake City which was then devoting major attention to the usual high school curriculum. He taught most of the science courses and introduced some on the college level.

During this school teaching career, he married Daisy Ferguson who bore him four children, Beth, Ralph, Della and Ruth. Not being content with high school teaching, he went to Stanford University, California during the summer of 1902 from whence, in the fall he went across the continent to Cornell University, New York on a Smith fellowship where he remained for two years. In 1904 he came back as Assistant Professor of Natural History to the University of Utah in its present location on the east bench and in the then new Museum Building (now the Biology Building.)

He immediately embarked upon a program that eventually led to elimination of classes in secondary education and establishment of more courses on a college level. Not content with raising the biology work to college standards, he immediately initiated premedical courses and at the end of two years, he was made dean of a new two year medical school which he firmly established during another two years. The medical curriculum was soundly based upon comparative studies of man and animals but did not neglect chemical, physical, botanical and bacteriological aspects.

In 1908, he transferred to the Brigham Young University at Provo as Professor of Zoology where he taught the usual zoological subjects. In addition, he instituted a course in evolution with the full knowledge, consent and approval of the University administration. His scientific teachings in this course were very revealing to most of his students but other students who did not comprehend his message spread tales that antagonized certain orthodox members of the Church, including the superintendent of Church schools and some members of the higher Mormon authorities.

Not being willing to retract his teachings nor deny his scientific attitude, he found himself in an untenable position in 1911 and left the school under conditions well described in the words of the poet:

Though man a thinking being is defined
few use this grand prerogative of mind
How few think kindly of the thinking few
How many never think who think they do.

The next two years were spent at the University of Pennsylvania, after which he moved to Harvard University as curator of Myriapods, Arachnids and Vermes (or in common terms, millipeds, spiders and worms) at the Museum of Comparative Zoology, where many of his scientific contributions were made.

During this time he married Edith Simons on June 28, 1922. They had six children, Eliott, Frances, Helen, Shirley, Edith and Martha Sue.

His decision to return to Utah in late 1925 was fraught with some misgivings but a new generation with more tolerant attitudes was arising and he found the University of Utah welcomed him back. He was made head of the departments of Botany and Zoology, the teaching staff of which at that time consisted of a botanist, a zoologist and an instructor. He again began building the field of biology and by the time he retired in 1948, there were listed in the catalog 16 professors of different rank, 7 instructors and 3 special lecturers, serving the departments of Biology, Botany and Zoology. The total class registrations rose from 978 in 1925-26 to 8,884 for the regular school year of 1946-47, the high point in registration. Part of this was due to growth of the University but much of it must be ascribed to rapid differential growth of the biology work.

When he arrived in 1925, the biology group was crowded into two laboratories and two offices in the northeast end of the second floor of the present biology building. He did not even have an office and had to put his desk in the hall for a short time. It was not long, however, before increasing class enrollments and bulging classrooms started a movement whereby other occupants of the building moved elsewhere and the entire building was filled with biological work. It was with some amusement that we who were there at the time viewed the departure of the last occupant, hastened by the autopsy of an odoriferous bear.

Biology not only expanded in volume but also in scope. In the early thirties, Dr. Chamberlin backed a movement to abstract from Botany and Zoology some of the fundamental data common to both and establish general biology courses that could be used as a foundation for each field. At the time of his retirement, he recommended the segregation of the biology work in the School of Arts and Sciences (now University College) into five departments, General Biology, Botany, Invertebrate Zoology, Vertebrate Zoology, and Genetics, which with courses taught by four departments of the Medical School, Bacteriology, Anatomy, Physiology and Biochemistry became the present Division of Biology.

Wherever he has been, he has produced unusual stimulation in students, many of them becoming imbued with his enthusiasm for the use of accurate tested knowledge. Many caught the vision of what human life can mean when viewed in the light of man's evolutionary background and interpreted in terms of his emerging intelligence by which he has outdistanced so many of his animal competitors in the evolutionary race.

In the early development of the Extension Division Lecture Series,

he played an important role in making the series popular. He assisted in organizing some of the series and being a purposeful and convincing speaker, he drew large audiences.

In Utah, since his last return to the state, his students have been fanning out into society year after year for more than two decades, carrying the vision with them. They have gone into many positions in society where many of them have helped to make social thinking more responsive to the idea that natural principles and processes must be heeded in explaining man's position in nature and in guiding his affairs on earth.

The culmination of this point-of-view is found in his Reynolds Lecture on The Kingdom of Man, in which he states: "The history of human progress is a story of emancipation, and its course has by no means been run. The future of the race is in all likelihood to be a scientific future, since science gives the truth needed in actual life and furnishes the means for advance, every achievement enlarging the field of subsequent possibilities. Nothing can stop this growth except suppressions of freedom." Other important cultural contributions are found in his papers on "Science and Reality" and "Life in Other Worlds" which gives a history of opinion on the subject.

Perhaps nowhere has his influence been more marked than in the field of education, where his students have become teachers. By using tested knowledge with the natural process point-of-view, they have been able to pass his vision on to their students at an earlier stage in life so that in my estimation, a gradually increasing percentage of biology students come to the university with an open mind.

In the world struggle for power, perhaps there is no problem more pressing than that of controlling the open mind. Each power group must keep thought control over its followers. In the words of the play, South Pacific, "you've got to be taught before its too late, before you are six or seven or eight, to hate all the folks your relatives hate." Where the power over life, health and wealth is kept in the hands of leaders that cannot be freely changed by the members at will as in Communist Russia, there is little or no chance for use of the open mind. Problems cannot be openly and dispassionately weighed.

In America, where governmental power is divided between executive, legislative and judicial branches and people entrusted with such power can be changed by the will of the electorate majority, then the open mind of the voter can be exercised no matter how violently opposing political parties contend for thought control over their members. There is opportunity for those with open minds to shift the balance of power from one to another and thus render them more responsive to the general welfare.

Similar problems occur in the field of religion where the leaders do not hold power of life or death over their members but must compete for social control. The great body of membership usually held together by reiterated teachings that tend to fix men's minds are usually bound together in thought-controlled patterns involving a supernatural source of the teachings.

The rapidly accumulating mass of scientific knowledge which has failed to verify many religious teachings or beliefs and has flatly disapproved many others has confused many religious people by the contradictions between these two great human institutions — science and religion. It is in this field of helping those in distress to understand these differences where Ralph Chamberlin has made one of his greatest cultural contributions. He has been able to lead the naive student with fixed religious convictions gently around that wide gulf that separated him from the trained scientific mind without pushing him over the precipice of despair and disillusionment. He has offered in place of doubt and disillusionment, attractive goals of research that lead toward clearer comprehension of the natural processes that determine the conditions under which his life can continue in this world and in this universe.

Of course, it must not be contended that Ralph Chamberlin was the sole or even primary cause of these enlightening shifts in cultural attitudes, but when it is considered how difficult it is to squeeze good ideas between prejudices in the minds of great masses of people indoctrinated with fixed ideas, cherished beliefs and wishful thinking, the magnitude of the task to be accomplished in opening their minds to the idea of natural processes becomes appalling. In America, the process of mass education and the trend from muscular to mental occupations have been important factors in prying minds open but the part played by the man we honor in assisting this transformation is not a minor role.

To him we all owe a deep debt of appreciation for the role he has played.

THE CONTRIBUTIONS TO SCIENCE OF

RALPH VARY CHAMBERLIN

By

Stephen D. Durrant

I am honored to be considered worthy to present the scientific accomplishments, and the contributions to knowledge of our esteemed and distinguished friend and colleague. In the same breath, I readily admit that I approach such a gargantuan task in humility. This man is no mere scholar, one of the common herd, but is a giant among his contemporaries. History will bear out that in his contributions to knowledge in the biological and other sciences, he marches abreast of such great figures as Baird, Merriam, Gray and others. What are the attributes possessed by our honored scholar that enabled him to attain such a position of eminence? Critical study of him as a person, and of his accomplishments, will reveal that he has three great beams in his searchlight that have permitted him to penetrate, probe and constantly push back the black curtain of human ignorance, and to increase the fund of human knowledge. First, a tremendously rich endowment of native ability; second, an inexhaustible fund of energy and ambition; and third, an insatiable curiosity to know about the unknown. When these three beams are directed upon any problem, elucidation of it is a foregone conclusion.

But how does one approach the problem of evaluating the contributions of such a man? There are two sources. The main, and most objective one is the bibliography of his published works. Here, he has committed himself, his findings and his philosophies to the cold black and white. This is for the world to judge, and judge it will, in a critical, calculating and impersonal manner. Deletions, additions, retractions and explanations are no longer possible. This is his monument, built of the past and present, to be judged by the present and the future. The second source, one which cannot be as accurately appraised as the foregoing, is the impact of his personality, industry and vision upon his colleagues and students.

Perusal of the bibliography of our man of the hour, leaves one in sheer amazement. His monument is so grandiose, well constructed and is so wide at the base that it can neither be readily encompassed nor understood; and it is so high that it extends beyond the grasp and attainment of all save a few. Its base reflects the breadth and scope of his studies, and its height, the excellence to which he conducted them. Numbers are dry and somewhat boring, but at the same time, they can be extremely enlightening. The published record shows that by 1900,

he had published 9 papers. During the decade 1900-1910, he published 26 papers; 1911-1920, 74 papers; 1921-1930, 75 papers; 1931-1940, 67 papers, 1941-1950, 106 papers, and 1951- to date, 46 papers. This makes a grand total of 403 contributions to science, consisting of thousands of printed pages. This is an imposing list of papers, but it becomes an even more remarkable tribute to his energy and productivity, when it is realized that this was not the sole call upon his energies during this time. As has already been set forth, he had throughout this period many other time consuming commitments of teaching and administration. He completely fulfilled the calling of a university professor, that is, teaching and research.

A cursory examination of the bibliography will indicate that he expounded upon many fields of human endeavor. I find titles in Folklore, Economics, Anthropology, Language, Botany, Anatomy, Histology, Philosophy, Education and History, all of which are somewhat removed from the fields of his greatest contribution. It is well known that the major part of his papers concern themselves with Arachnids, Chilopods and Diplopods, all members of the Arthropods. In addition, he has contributed significantly to knowledge in Insects, Molluscs and marine Annelids. All scientists, and especially taxonomists, have great respect for his work on the aforementioned arthropods, but I wonder if they realize the extent of his impact upon this field. His keen appreciation and understanding of variation in animals, and its significance in the picture of evolution, and his sharp perception of differences and relationships is reflected in his naming and describing of 4,225 new species, 742 new genera, 28 new families and 12 new orders. Moreover, he is remarkably active at the present time in his chosen researches.

With the exception of some books and larger articles, I was able to account for 58 different local, state, national and foreign publication outlets that have disseminated the knowledge that emanated from his studies. That the editors of these organs of publication thought highly of his contributions is attested by the fact that one, the Biological Society of Washington, alone, published 60 of his papers, while another, the Entomological News, published 51 and the Canadian Entomologist published 36.

This man is really a cosmopolitan in his writings. He pioneered the studies of his favorite forms in many parts of the earth. In literally combing through his myriad writings, one is impressed and awed by their scope in geographical application. A constant stream of reports of animals from the several corners of the earth flows before the readers' eyes. I know not from how many areas he had studied and reported upon the animals found there. This could be brought to light only by careful reading of each paper. Many, however, give localities in their titles. One finds his reports and new contributions to knowledge of Arachnids, Chilopods, Diplopods and other animals from 23 of the 48 states. Leaving aside for the moment his reports based upon specific, large scientific expeditions, one finds no continent and few

major islands that have escaped the scrutiny of his research. The list reads like a travel brochure, Alaska, India, Galapagos Islands, Costa Rica, East Indies, Mexico, West Indies, British Columbia, Panama, Peru, Canada, Guatemala, Australia, Bermuda, Hawaii, British Guiana, Santo Domingo, China, the Phillipines, Uruguay, Nicaragua, Yucatan, Saipan, Japan, Turkey, Crete, Chile and many others.

The excellence of his researches, the care and judgment employed in the elucidation of the data, soon brought great renown to him, and he was sought after to make critical studies and analyses of materials obtained by expeditions throughout the world. As early as 1914, he reported upon the Chilopods of the Stanford Expedition to Brazil. In 1916, he did the same for the Arachnids of the Yale Expedition to Peru. His monumental report in 1919, upon the Annelida (Polychaeta), for the trip of the "Albatross", by the United States Bureau of Fisheries is considered to be a classic of its time. Others include reports of the Canadian Expedition to the Canadian Arctic, University of Michigan (Bryant Walker) Expedition to Columbia, United States Biological Survey Expedition to the Pribilof Islands, the California Academy of Sciences Expedition to the Gulf of Lower California, "Williams" Expedition to the Galapagos Islands, University of Iowa Expedition to Barbados, Bishop Museum Expedition, American Museum of Natural History Expedition to the Congo, The California Academy of Sciences and the Lund University Expedition to Chile. Other collections that he has investigated and brought their materials to fruition are those of the Chicago Museum of Natural History, The Academy of Natural Science of Philadelphia, and the Department of Tropical Research of the New York Zoological Society.

Many of his papers are large, weighty tomes, but I was able to find the following that are of book-size. The large, two-volume work upon the marine annelids has already been alluded to. Doctor W. K. Fisher, former Head of Stanford's Hopkins Marine Station informed me that these two volumes make up one of the great monuments in this field, and was the basic contribution that enabled students of these animals to then make rapid, significant advances. This was considered the "keystone" publication. Early in his career, he wrote "The Meaning of Organic Evolution." This was at a time when the word evolution was a nasty one. Here, we see the same careful, unbiased, unemotional, logical application of the scientific method to set forth and develop this principle. Here again, he was a pioneer in this field in this region. Other books include one on the philosophy of his brother, memories of J. R. Park and a History of the Life Sciences at the University of Utah. At present, he has practically finished a commission given him to prepare the history of the University of Utah. There appears to be no limit to the scope and capacities of this man; he has been so eminently successful wherever and whenever he has put his mind to the task.

Naturally, writings prepared with the precision he gives them, and smacking of one who writes with authority, are widely sought after. Students who are not abreast of his writings can do little in this field.

As you would suspect, his mailing list is tremendous. His writings find their way into every library of any consequence in our own country, and are widely disseminated throughout private collections where they are vitally important in research. Scientists in Argentina, Austria, Brazil, Canada, England, Finland, Formosa, France, Germany, Holland, India, Japan, Peru, Portugal, Norway and Sweden are recipients of his papers. Furthermore, he knows many of these foreign scientists personally, having traveled in Europe and Central America.

I have attempted to give you an abbreviated view into the published accomplishments of our honored scholar and friend. Time precludes that I say much more, but I would be remiss and could rightly be accused of dereliction to duty if I did not set before you some of his nonetheless great, but more intangible contributions. These concern his research in men and the fruits of his teachings. These, I personally experienced, hence, they are such that I have first hand information. He moved among us with a quiet dignity, yet at all times we sensed his greatness. By word, and especially by precept, he taught us diligence, inquisitiveness, love of truth and especially scientific honesty. As is common to all great teachers, he led us, but at the same time we felt the gentle nudgings to improve and extend ourselves. He often said "Teachers should seek new information, if they are real, live teachers. Show me a teacher who is not doing some research and I will show you a teacher who is dying." Toward all his staff, he exerted a gentle pressure to do research, realizing full well that few could accomplish a great amount in those days of heavy teaching loads. This insistence bore fruit as is testified by the hundreds of papers published by his students and staff. It is difficult to evaluate the total influence of one man upon others, but a quick survey will disclose literally dozens of theses for advanced degrees prepared by his students or by students of his students. In addition, many of his advanced students now occupy important posts in the educational and scientific world. His stimulus and ability to motivate those around him has been inestimable. As has often been said, if a stone is thrown into a quiet pond, it is impossible to measure its total effect.

Ladies and Gentlemen, this is my humble attempt to present the accomplishments of the man, one of Utah's most illustrious sons, and certainly the peer of all her sons in the biological sciences, Ralph Vary Chamberlin.

BIOLOGICAL RESEARCH AT THE UNIVERSITY OF UTAH

By William H. Behle

The history of biological work at the University of Utah up to and including 1948 has been exhaustively treated by Chamberlin.¹ After an early period of natural history teaching, a new era began about 1890 when courses were set up in Botany, Zoology and Physiology. When the School of Medicine was established, Physiology was transferred there and for several decades biological work was administered under two departments, Botany and Zoology, although from 1926 to 1931 they were under the same head. In the latter year the two departments were brought together under a common divisional heading, Biology. At this time a third subdivision was created under the heading, "General Biology." About this time too, a general education program was established. In subsequent years under the dynamic leadership of Dr. Chamberlin, enrollment, staff, and course offerings grew at a rapid rate.

When Dr. Chamberlin retired in 1948 a Division of Biological Sciences was established to integrate all the biological work. There were two sections, Medical and Biology. The departments of Anatomy, Bacteriology, Biological Chemistry and Physiology, while administered under the College of Medicine also offered courses in biology for the University College (now known as the College of Letters and Science), and this aspect of their work was to comprise the Medical Section of the Division of Biology. The main part of the Division entirely under the University College was the Biology Section. In this there were five departments, some newly established. A Department of General Biology was created with William H. Behle as head. The primary concern of this department was the general education program, but it also included several courses with subject matter common to the several areas, such as conservation, biogeography, teaching of biology, and biometry. Also placed here was a new area being developed, namely experimental biology. Botany continued under Walter P. Cottam. A new department of Genetics and Cytology was established with W. W. Newby as head. Zoology was divided between Invertebrate Zoology under Don M. Rees and Vertebrate Zoology under Angus M. Woodbury. The several department heads in both sections served as the Executive Committee. Horace W. Davenport, head of the Department of Physiology, served as chairman. Being in the Medical Building he was somewhat removed from the main area of the Biology Building, so William H. Behle served as Executive Secretary of the newly created

¹Chamberlin, R. V. 1950. Life Sciences at the University of Utah, background and history. Univ. Utah, xv + 1-417.

Division. In 1951 Don M. Rees became chairman. The following year the position of Executive Secretary was discontinued, there no longer being need for two executive positions.

In 1954 yet another reorganization was effected. The departments of Invertebrate and Vertebrate Zoology were amalgamated. Dr. Woodbury retired. The department of General Biology was discontinued. Dr. Behle became Director of Biology General Education and as chairman of the Biology Area General Education Committee and a member of the Executive Committee of the Division of Biology continues to direct this program. The general education — general biology courses were simply designated as Biology 1 and 2 and listed under the Division. All other courses formerly known as Biology were routed to the other departments for administration. A new department of Experimental Biology was instituted with John D. Spikes as chairman. Essentially physiology, it was so called to distinguish between this area in the Biology Section in the University College and the Department of Physiology in the College of Medicine. In 1956 the courses in general human physiology were transferred from the Department of Physiology to the Department of Experimental Biology, leaving the former with just the advanced human physiology for medical students. The heads of the departments of Botany, Genetics, Experimental Biology, Zoology and the Director of Biology General Education now make up the Executive Committee of the Division of Biological Sciences. Since the Medical Section plays a minor roll, the Division is virtually synonymous with the Biology Section.

Thus after considerable adjustment a somewhat unique and workable organization has been effected with a well-rounded core of course offerings, a nice balance of staff, together with leadership provided in the various areas and with the administrative burden shared. The staff provides specialists in many fields and as a consequence of all this there is great stimulus to research in the several disciplines of biology. Incidentally the first masters degree in the field of Biology was given in 1910. Only three had been given to 1926. The number to August, 1949 was 107. As of the present there have been 203. The first Ph. D. degree was bestowed in August, 1949. To date there have been 17 granted.

In the administrative framework described there is a budget set up for the Division. Funds for supplies and current expenses are allocated by the Executive Committee to the several departments as well as the general education area, and these separate accounts are administered by the executive officers concerned. Funds for staff, equipment and assistants are handled on a divisional basis. There is a common man-power pool. Some staff members work exclusively in one department but many cut across departmental lines. Nearly every one, representing all academic ranks, participates in greater or lesser degree in teaching sections of the general biology courses. A progressive system of courses with various starting levels for fulfilling the general education requirements in the biology area is another story for

another time. Here the intent is to present the research aspects of the Division of Biological Sciences. The various staff members have been listed in the school catalog under departments according to their major research and teaching interests. A discussion of the four current departments follows together with the staff members under each. In addition to those mentioned there are three Professors Emeriti, doctors Ralph V. Chamberlin, Fayette E. Stephens and Angus M. Woodbury. Dr. Margaret Schell, formerly on the teaching staff, now serves as librarian for the division. The Biology Series is in its eleventh volume.

Many members of the staff have, from time to time, been successful in obtaining grants to support their research from such agencies as the University of Utah Research Fund, the U. S. Atomic Energy Commission, National Science Foundation, and U. S. Public Health Service. The largest amounts have gone to the Departments of Experimental Biology and Botany and the Laboratory of Human Genetics but a surprising amount of support has been forthcoming for systematic, faunistic and ecological research. Mention should also be made of a study of several years standing on the ecology of disease transmission in native animals carried out by a unit known as Ecological Research, University of Utah, at Dugway, Utah, under contract with the U. S. Army Chemical Corps. Another project getting under way involves ecological studies in connection with the Glen Canyon Reservoir and the Upper Colorado River Basin. This is supported by the U. S. National Park Service. Both of these enterprises have drawn on the staff and facilities of the Division of Biological Sciences at the University of Utah. Dr. A. M. Woodbury was director of the Dugway project and now heads the Glen Canyon survey.

Botany

This department has three spheres of research activity, plant physiology, systematic studies and ecological studies. The local environment with its great physiographic diversity and a range from fresh to salt water provides unique opportunities for the study of plant and animal problems in the field. In the Greenhouse are laboratories and equipment for research in plant physiology and plant genetics. Current research includes studies of the physiology of salt-tolerant plants, arsenicals as pre-emergent herbicides, effects of atmospheric fluorides on basic plant processes, and experimental taxonomy and cytogenetics of *Mimulus* and other plant groups. The Garrett Herbarium contains nearly 50,000 mounted specimens of flowering plants representing the diverse flora of Utah. In addition there are more than 12,000 specimens of mosses. Studies are being made of the ecology and floristics of the Grand Canyon National Monument, Cedar Breaks, and Bryce Canyon, the speciation and distribution of oaks in Utah and northern Arizona; the ecology and distribution of algae and bryophytes; special aspects of mycology and plant anatomy.

Two Research Associates of the department are Dr. Lincoln Ellison

of the U. S. Forest Service Intermountain Range Experiment Station and Dr. Bert L. Richards, Research Consultant in Air Pollution.

Walter P. Cottam. Dr. Cottam received his Ph. D. degree from the University of Chicago. His interests and research work have centered on the floristics and ecology of the plant life in Utah and the analysis of biotic communities. He has been especially concerned with successional features related to grazing and in this connection has worked closely with the U. S. Forest Service. His most widely known publication is the pamphlet entitled "Is Utah Sahara Bound?" which is a critical evaluation of the changes in the vegetation of the state and the causes. Dr. Cottam is widely known for his artistry in photography. A dynamic teacher, he offers courses in local flora, Utah plant life, biogeography, and general ecology.

Seville Flowers. Dr. Flowers is another member of the staff who received his Ph. D. degree at the University of Chicago. While his training also included the general fields of ecology and physiology his principal teaching concern in the department is the advanced courses in the morphology and systematics of the various groups of plants. His chief research interest is centered on the Bryophytes and he is widely known for his taxonomic and illustrative work in cryptogamic botany. His monograph on the Ferns of Utah is widely used. Similar work on the mosses, algae and lichens of the state are in preparation.

Irving B. McNulty. Dr. McNulty started his botanical career studying ecology but in recent years has moved into the field of plant physiology. He received his Ph. D. degree at Ohio State University. He teaches general botany and plant physiology. His research interests are currently centered on the following problems: the use of arsenicals for the control of annual weeds; the effect of extraneous endogenous potassium and sodium salts on plant metabolism, e.g. respiration and photosynthesis; the effects of fluoride pollutants on respiration and plant pigments.

Robert K. Vickery. Dr. Vickery divides his time almost equally between Botany and Genetics since he is interested in the classification of plants from the standpoint of cytogenetics. In the Botany Department he teaches courses in the local flora and plant systematics. In the Genetics Department his courses are in genetics and the origin of species, plant genetics and radiation genetics. His research centers on the genus *Mimulus* and includes investigation of the cytogenetic relationships of the various species, experiments to determine the genetics of flower color, and studies on the physiological characteristics of the races and species of the group. His doctorate was obtained from Stanford University.

Genetics and Cytology

This department offers instruction and research opportunities in heredity, evolution, development, cytology and statistics. There are

laboratory facilities for genetic, developmental and radiation studies of *Drosophila* and for similar studies of plants. The Laboratory of Human Genetics contains records of several hundred family groups. Current research of this laboratory includes studies of the genetics of cancer and other abnormal growths, muscular dystrophy, deafness, and other degenerative disorders. Dr. F. V. Owen, Geneticist with the USDA Agricultural Research Service is a Research Associate of the department.

William W. Newby. As in the case of Dr. Vickery, Dr. Newby serves as an example of the effectiveness of our Divisional plan, whereby the staff cuts across departmental lines. He is chairman of the Department of Genetics and Cytology and teaches sections of the general education heredity course and a course in development. In addition he gives the course in Vertebrate Embryology taken largely by premedical students. Dr. Newby is the Premedical Counselor in the general education program of the University. His early research was on the embryology of the worm *Urechis*. His later work has been on developmental anatomy and gene action in *Drosophila*. Dr. Newby is known for his excellent illustrative work. He obtained his Ph. D. at Stanford University.

Charles M. Woolf. Dr. Woolf is director of the Laboratory of Human Genetics, having recently succeeded Dr. Fayette E. Stephens who reached retirement age. Dr. Woolf teaches courses in genetics, human genetics, and biometry. His research has been mostly devoted to human genetics with a special interest in the genetics of human cancer. His publications, however, have dealt with *Drosophila* genetics; statistical-genetical studies on carcinoma of the stomach, breast, and large bowel in man; and frequency of consanguineous marriages among the Mormons in the United States. He received his doctorate at the University of California at Berkeley.

Robert K. Vickery. See under Botany.

Benjamin Hochman. Dr. Hochman is the latest addition to the staff of the Genetics Department, having succeeded Dr. George Lefevre. He received his Ph. D. degree from the University of California. In addition to supervising the laboratory work and teaching sections of the large general education course in heredity, he teaches the advanced course in genetics for premedical students and majors as well as the course in cytology. His primary research interest is in population genetics, with special reference to *Drosophila*. A recent phase has been a study of competition between wild type isoalleles in experimental populations of *Drosophila melanogaster*.

Experimental Biology

From the previous resumé it is evident that this department was established to organize and coordinate research and instruction primarily in the physiological phases of biology. The subject matter is

dynamic since it includes the vital, living activities of organisms. Students majoring in the department are trained with one chief purpose in mind, namely preparation for the investigation of the chemical and physical processes of living things and of the cells that compose them. In addition to the usual basic courses in the biological sciences, majors in experimental biology are required to take an extensive sequence of courses in chemistry, physics, mathematics and biochemistry. The laboratory provides spectrophotometers, Warburg apparatuses, electronic equipment, tracer facilities, an ultracentrifuge, machine shop, specialized equipment for photobiology work, facilities for raising plants under controlled conditions, gas analyzers, etc.

Current research includes studies of photosynthesis, certain aspects of algal metabolism, the effects of ultra violet and gamma radiation on plant and animal metabolism, active transport studies with plants and animals, and certain aspects of avian physiology. Dr. Myron Stout, physiologist with the Sugar Beet Division of the USDA Research Service is a Research Associate of the Department of Experimental Biology.

John D. Spikes. Dr. Spikes' training was at the California Institute of Technology where he obtained his Ph. D. degree and specialized in chemical embryology, plant biochemistry and immunochemistry. He teaches the courses in general physiology, comparative animal physiology and methods in experimental biology. His research interests have led to publications on sperm and egg metabolism, the fertilization process, the chemical and photochemical reactions carried out by isolated chloroplasts, plant metabolism, radiation biology, enzyme mechanism, active transport, the mechanical-molecular properties of tendon and other animal structures, and the thermodynamics of biological systems.

Richard W. Van Norman. Dr. Van Norman is a product of the University of Minnesota where he obtained his Ph. D. degree. His chief research interests center on photosynthesis and cellular metabolism. In addition to teaching several sections of general biology, he gives the course in elementary experimental biology which is designed to illustrate the application of the physical-chemical-mathematical approach to biological problems. It is especially suggested for engineers and for chemistry, physics and mathematical majors.

James R. King. Dr. King in his early work specialized in vertebrate ecology, but turned to avian physiology. His research interests have led to publications in avian ecology, distribution and life history and more recently the behavioral and physiologic aspects of avian migration. He teaches the elementary human physiology. He received his Ph. D. degree at Washington State University.

Zoology and Entomology

Instruction and research opportunities are offered in the various

phases of entomology, parasitology, protozoology, arachnology, ichthyology, limnology, herpetology, ornithology, mammalogy, ecology and animal behavior, conservation, comparative anatomy, development and general zoology. From the beginning there has been emphasis on taxonomic work at the University of Utah and large collections are housed in the Invertebrate and Vertebrate museums. The former contains a world-wide collection of arachnids and myriapods consisting of about 160,000 specimens. The entomological collection contains about 420,000 specimens. Current research in invertebrate zoology includes studies of: the ecology and control of various Diptera including mosquitoes, black flies, and chironomid gnats; the Ephemeroptera; certain families of Coleoptera, Formicidae, millipedes, centipedes, spiders, and mites; parasites of animals of the Great Basin and other geographic regions; the physiology and morphology of free-living protozoa.

The vertebrate museums contain mainly western forms and include about 16,000 bird skins, 15,000 mammal skins, 4,000 fish and 2,000 amphibians and reptiles. Current research includes studies of the morphology, systematics, distribution and ecology of all classes of vertebrates.

Lately established is a Laboratory of Aquatic Zoology which permits life history and ecological studies on aquatic insects, fish and other animals. Current research in this area includes studies of the biology and life histories of mosquitoes, mayflies, and other aquatic insects; also the invertebrates of polluted waters.

Don M. Rees. Dr. Rees' field of research is economic entomology with particular reference to mosquito control. He has long been active in mosquito abatement work locally and nationally. His best known publication is a bulletin on the mosquitoes of Utah, an excellent work on the biology and control of mosquitoes of the Western United States. He teaches courses in general, medical, and economic entomology. He is presently on leave at the University of Indonesia where he is teaching medical entomology and mosquito taxonomy and aiding in the organization of the entomological coursework in the new school of medicine. His doctorate was obtained at Stanford University.

William W. Newby. See under Genetics.

Stephen D. Durrant. In teaching, Dr. Durrant's area of responsibility embraces the courses in comparative vertebrate anatomy, vertebrate phylogeny and mammalogy. He serves as curator of mammals and his research is concerned with the taxonomy and distribution of the mammals of Utah on which he has published extensively. He has also summarized the information in book form: *The Mammals of Utah*. He received his Ph. D. at the University of Kansas.

William H. Behle. Although most of his time is devoted to the general education program in biology, he teaches a course in field zoology of local vertebrates and the course in ornithology. He serves as curator of birds. In his research he is concerned with the distribution and variation of the geographically variable forms in western North America. In this connection he is carrying on an active program of

avifaunistic surveys which leads to systematic revisions. He is also studying the colonial nesting birds on the islands of Great Salt Lake.

Frederick R. Evans. Dr. Evans teaches the introductory course in comparative invertebrate zoology for premedical students. He serves as general education counselor for pre dental students and those majoring in biology. He also teaches the histology and microscopic technique and protozoology. The latter represents his specialty and field of research. He received his Ph. D. at Stanford University.

Albert W. Grundmann. Dr. Grundmann's specialty is parasitology. He also teaches courses in general zoology, insect embryology and insect physiology. His early research was on the Formicidae. He has worked on the transmission of equine encephalomyelitis, on gall wasps and is currently concerned with endoparasites of mammals. His Ph. D. degree was obtained from Kansas State College.

Stanley B. Mulaik. Dr. Mulaik is a versatile member of the staff with many interests and lines of endeavor. He is the instructor of the courses in natural history, teaching of biology, arthropodology and field, museum and laboratory techniques. In his research he has worked on the taxonomy of spiders, isopods and mites primarily. He obtained his Ph. D. degree at the University of Utah.

George F. Edmunds, Jr. Dr. Edmunds teaches the courses in systematic and aquatic entomology as well as a course in the principles of taxonomy. His special research interest centers on the biology and taxonomy of mayflies (Ephemeroptera). Of late he has also been concerned with industrial air pollutants as an ecological factor in insect outbreaks on vegetation. He obtained his Ph. D. degree at the University of Massachusetts.

Arden R. Gaufin. Dr. Gaufin's chief teaching responsibilities are the courses in limnology, ichthyology, and fisheries biology. His early research dealt with the classification of termites and mosquitoes and their control. His current research is concerned with the effects of pollution on macro-invertebrates and fishes and with taste and odor problems in water supplies. He received his Ph. D. degree at Iowa State College.

Lewis T. Nielsen. Dr. Nielsen's primary teaching responsibility is general biology where he serves as coordinator of all the laboratory work. His area of special training is entomology and he regularly teaches the course in insect morphology and occasionally general zoology, entomology and genetics. His research has been on the biology, taxonomy, distribution and control of mosquitoes in the Rocky Mountain region, particularly the montane forms. He obtained his doctorate at the University of Utah.

John W. Twente, Jr. Dr. Twente's specialty is animal ecology with particular emphasis on behavior. He teaches general vertebrate zoology, herpetology and animal ecology and publishes primarily on bats. Current researches include ecological and behavior studies. His Ph.D. was obtained at the University of Michigan.

M. Raymond Lee. Mr. Lee (M.S., Utah) is instructor in general biology and is working for the Ph.D. in mammalogy.

THE ORGANIZATION AND PURPOSE OF THE ASSOCIATION OF COLLEGE HONOR SOCIETIES

The Association of College Honor Societies was organized October 1, 1925, by a group of college and university teachers, administrators, and representatives of a few well-established honor societies. Its object was then and is now to consider problems of mutual interest such as those arising from the confusion prevailing on college campuses concerning the character, function, standards of membership, multiplicity, and undesirable duplication of honor societies; to recommend action leading to appropriate classification, higher standards, reasonable cost of membership, consolidation or elimination; and to promote the highest interests of honor societies.

This movement, started by Phi Beta Kappa and Sigma Xi, has developed quietly through the years to bring about greater responsibility and usefulness among college honor societies. The growth of the honor society idea since 1900 has been rapid and varied. Many groups are of local significance only, while a number have expanded to other colleges and universities and seek to be recognized as national in scope. Their multiplicity, and in many cases their duplication, low standards, and competition, presents a burdensome problem to students, faculty members and administrators, and to college life generally. It was with this situation in view that the ACHS was organized.

There were six initial honor societies in the ACHS: Phi Beta Kappa, in liberal arts; Sigma Xi, in scientific research; Tau Beta Pi, in engineering; Phi Kappa Phi, in all academic fields of university scope; Alpha Omega Alpha, in medicine, and the Order of the Coif, in law.

Provision was made for responsibility to be lodged in the Council which consists of an official representative of each member society. Provision was made also for meetings, admission of other societies found to have proper qualifications, for admission fees and annual dues, and for needed studies, reports and recommendations.

The problem faced by higher education and by the ACHS of developing and maintaining high standards in college honor societies covers the whole college field and all categories of Greek letter organizations. Individual associations and conferences in the general social and professional fields are also studying ways and means of improving conditions. Educational associations and councils are co-operating. While progress was slow and difficult at times during the early history of the ACHS, great progress has been made during the past ten years by joint action of college administrators and faculty members and representatives of the major societies and fraternities and their respective associations. The real solution of the problem requires such a co-operative combination of forces.

The objective of the ACHS now is to encourage all general and departmental honor societies to join forces for the establishment and maintenance of desirable standards and useful functions in higher education, and for the achievement of appropriate recognition of member societies of the Council of ACHS. To this end, the ACHS invites qualified societies to affiliate with it. Societies which do not meet the standards will be helped in every way possible to come up to them. Special attention is called to the Constitution and By-Laws of the A.C.H.S. and to their statements of definitions, standards, and requirements for membership and functions of honor societies which appear elsewhere in this booklet.

(From 1957 A.C.H.S. Booklet of Information)

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NEW CHAPTER OF PHI SIGMA INSTALLED AT THE UNIVERSITY OF VIRGINIA



Charter members and honored guests assembled at installation banquet in hallowed ROTUNDA of The University of Virginia, March 22, 1958. Left to right by rows: Row 1—Mrs. Richard Crowley, Lewis M. Hammond, Jim Kemp, Mrs. Ralph Singleton, Burton D. Goodwin, James Norman Dent, Ralph Singleton, Joseph L. Vaughan, F. S. Orcutt. Row 2—Richard L. Crowley, J. David Deck, Rosemary Johnson, Robert Ridley Cardell, Jr., John M. Stehlik, Lester Nelson Krawitt, Thomas Lee Johnson, Thomas Clement Cheng, Raymond C. Bice, Glenn R. Hawkes, Paul C. Vesper, Mrs. R. D. McKinsey. Row 3—Muriel L. Beuschlein, Mrs. Muriel Beuschlein, Mrs. L. R. Emmons, L. R. Emmons, D. Hugh Puckett, Robert L. Rhyne, William F. Battig, James D. Via, William H. Cook, Jr., Richard McKinsey, H. H. Hobbs, Jean E. Pugh, Edward Lautenschlager.

PHI SIGMA REACTIVATED AT EMORY UNIVERSITY, GEORGIA

The Emory University chapter of Phi Sigma has been reactivated. The chapter is under the leadership of Professors W. B. Baker, C. G. Goodchild and William Brillhart.

Officers elected from the new membership include Robert A. Pedigo, president; Kenneth Walker, vice-president; Diane Oakerson, recording secretary; Herbert Goodman, corresponding secretary and editor, and Thomas W. Brooks, treasurer. Dr. Anthony Clement was named faculty advisor and Dr. W. B. Baker is council representative.

At initiation ceremonies the following were elected to membership: Jack Sartain, W. Donald Fattig, Mrs. Billie Ruth Bird, Allen Jerome Blass, Barbara Powell, Herbert Goodman, Thomas W. Brooks III, Kenneth Walker and William R. Bartholomew.

Also invited to membership were Elbert W. Schmitt Jr., Michael Harkey, Lynn Raulerson, Michael Collins, Michael Watterson, Bernhard Weinhardt, Jeanne Matthews, Diane Oakerson, Herbert Davis, David J. Cotter and Robert A. Pedigo.

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NEWS OF THE ALPHA IOTA CHAPTER OF PHI SIGMA, BUCKNELL UNIVERSITY, LEWISBURG, PA.

Current officers are: President—Lane Wong, Bucknell Women's College; Vice President—Karen Reynolds, Bucknell Women's College; Secretary—Fred Hauk, R. D. #2, Selinsgrove, Pa.; Treasurer—Richard White, Box 146, Bucknell University; Acting Editor—Marian Brice, Box W-40, Bucknell U.; Council Representative—Dr. Roy C. Tasker, 431 Taylor Hall, Bucknell University.

On the 16th of November, 1957, three pledges were initiated. They were Gary Beidler, who presented a research paper titled "The History and the Use of the Artificial Kidney," Marian Brice, whose paper dealt with the plant ecology of Gothic, Colorado, and vicinity, and Thomas Johnston, whose paper was titled "Staining Techniques for Adrenal Glands."

Pledged March 12th, 1958 were Carol Cagle, Florence Creely, Charles Favino, Norma Fry, Nancy Honker, James Jefferson, Shirley Kropp, Margaret Marquardt, and David Pearah.

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NEWS OF NU CHAPTER OF PHI SIGMA, WASHINGTON & JEFFERSON COLLEGE, WASHINGTON, PA.

Officers are: President—Arnold Eisenfeld; Vice-Pres.—Carl Fetenhour; Secretary—Henry Gelband; Treasurer—Howard Stock; Editor—James Bress; Council Representative—Dr. C. D. Dieter.

Nu chapter has been holding regular meetings during the academic year for the purpose of reporting on and discussing biological topics of current interest.

We now have 462 alumni members, 20 active undergraduate members, and five active faculty members: Dr. C. Dewey Dieter, Dr. Homer C. Porter, Dr. Norman Vogel, Mr. B. George Osterman, and Mr. Kirk McCullough.

Our chapter's faculty advisor is Dr. C. Dewey Dieter, head of the Dept. of Biology and president of the Washington County Health Society, and on the board of the Pennsylvania Tuberculosis and Health Society.

Nu Chapter has performed many service projects in the past including: Entertaining the Pennsylvania Academy of Science, holding open house for the Biology Dept. and the College, holding an open meeting with the Washington County Medical Society, and holding an open meeting in cooperation with the Washington branch of the American Cancer Society.

Each year a central topic in the field of biology of particular significance and interest is chosen, and this becomes the theme of our reports and discussions. This current school year our topic is "Radiation in Biology." In this ever-increasing scientific age we live in, the necessity of exploring thoroughly the field of radiation has become an immediate concern. We have probed into the history of radiation with such topics as: The Effects of the Atomic Bomb in Japan, and The History of Radiation. Talks and movies on Radiation in Physiology and Biochemistry, Radiation in Cancer, and Treatment of Excess Radiation have brought our central topic up to the present generation. Further lectures on Radiation in Genetics and Embryology have given us a preview of what to expect from radiation in the future.

April 11 initiates were: King Hartman, Sidney Steiner, Matthew N. Boulis, E. Ronald Salvitti, Stuart Siegel, Robert Gordon, Ronald D'Altorio, Joseph P. Mock, David Feldman, Norman Berkman, Sheldon Weinstein, Michael Zimmerman, Harvey Benovitz, Joel Shelkrot, David Odle, Jack Dym, Morton Goldstein, Harry Johnson, Roger Jones.

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NEWS OF ALPHA KAPPA CHAPTER HUNTER COLLEGE, NEW YORK

Officers are: President—Miss Isabel Snow, Vice President—Dr. Melvin S. Schwartz, Treasurer: Miss Ingeborg Lichtenberg, Secretary—Miss Muriel Esther Bergman.

THE BIOLOGIST

THE COUNCIL

Printed by Cushing and Malloy in Ann Arbor, Michigan, for the Phi Sigma Society, a nonprofit educational organization, devoted to the promotion of research interest in the biological sciences. Founded at Ohio State University 17 March 1915, the Phi Sigma Society is a member of the Association of College Honor Societies. THE BIOLOGIST is the official quarterly publication, issued ordinarily on the 15th of September, December, February and May, as a stimulus to the fellowship in science for which Phi Sigma stands and as a medium of exchange between Chapters. The Council Officers assume no responsibility as to the opinions of the contributors to this publication.

HONORARY PRESIDENT: Dr. Laurence H. Snyder, Dean of the Graduate School, University of Oklahoma, Norman, Okla.

PRESIDENT: Dr. Karl F. Lagler, Department of Fisheries, University of Michigan, Ann Arbor, Mich.

PAST PRESIDENT: Dr. Arthur I. Ortenburger, 933 Wilson St., Norman, Okla.

VICE-PRESIDENT: Dr. Henry van der Schalie, Museum of Zoology, Ann Arbor, Mich.

SECRETARY-TREASURER: Dr. Fred S. Orcutt, Hillcrest Dr., Blacksburg, Va.

EDITOR: Dr. Anselm M. Keefe; assisted by Dr. Henry van der Schalie (Fall issue) and Dr. Karl Lagler (Spring issue), 1957-58.

MILE POSTS

- 1915 March 17, Alpha Chapter organized, Ohio State University, Columbus.
- 1916 May, Central Governing Body organized, "Biologist" first issued.
- 1924 December, First National Meeting, Constitution revised, Washington, D. C.
- 1925 December, Second National Meeting, Kansas City.
- 1926 December, Third National Meeting, Philadelphia.
- 1928 December, Fourth National Meeting, New York, Coat-of-arms adopted.
- 1930 January, Council Meeting, Ritual revised, Norman, Okla.
December, Fifth National Meeting, Cleveland.
- 1931 Phi Sigma Letters Registered, U. S. Patent Office.
- 1933 June, Sixth National Meeting, Chicago.
- 1935 December, Seventh National Meeting, St. Louis.
- 1937 December, Eighth National Meeting, Indianapolis.
- 1939 December, Ninth National Meeting, Silver Anniversary, Ohio State University, Columbus.
- 1941 December, Tenth National Meeting, Dallas, Texas.
- 1946 December, Eleventh National Meeting, Boston, Mass.
- 1948 December, Twelfth Meeting, Albuquerque, N. Mex.
- 1950 December, Thirteenth Meeting, Denver and Boulder, Colo.
- 1952 December, Fourteenth Meeting, St. Louis, Mo.
- 1954 September, Fifteenth Meeting, Gainesville, Fla.
- 1956 September, Sixteenth Meeting, Ann Arbor, Mich.

Phi Sigma is a Member of the Association of College Honor Societies, and Associate Member of both the A.A.A.S. and the A.I.B.S.

CHAPTERS FOUNDED

ALPHA — Ohio State University, Columbus, Ohio, 17 March 1915.

BETA — University of Michigan, Ann Arbor, Michigan, 3 June 1916.

GAMMA — North Dakota Agricultural College, Fargo, North Dakota (1916).

DELTA — University of Maine, Orono, Maine, 27 January 1917.

EPSILON — University of Denver, Denver, Colorado, 5 March 1917.

ZETA — University of Wisconsin, Madison, Wisconsin, 30 May 1917.

ETA — University of Akron, Akron, Ohio, 20 April 1921.

THETA — Michigan State College, Lansing, Michigan, 9 April 1921.

IOTA — Washington University, St. Louis, Missouri, 28 May 1921.

KAPPA — University of Kansas, Lawrence, Kansas, 31 May 1921.

LAMBDA — University of Montana, Missoula, Montana, 4 May 1921.

MU — University of California, Berkeley, California, 27 April 1922.

NU — Washington and Jefferson College, Washington, Pennsylvania, 11 May 1922.

XI — University of Nebraska, Lincoln, Nebraska, 3 May 1924.

OMICRON — University of North Dakota, Grand Forks, North Dakota, 26 May 1924.

PI — Emory University, Georgia, 3 January 1925.

RHO — University of Illinois, Urbana, Illinois, 28 March 1925.

SIGMA — University of Florida, Gainesville, Florida, 4 December 1925.

TAU — Duke University, Durham, North Carolina, 4 March 1926.

UPSILON — Miami University, Oxford, Ohio, 7 May 1926.

PHI — University of New Hampshire, Durham, New Hampshire, 21 May 1926.

CHI — Montana State College, Bozeman, Montana, 11 February 1927.

PSI — University of Washington, Seattle, Washington, 7 April 1928.

OMEGA — University of Oklahoma, Norman, Oklahoma, 24 March 1928.

ALPHA ALPHA — University of Southern California, Los Angeles, California, 17 May 1928.

ALPHA BETA — Mount Union College, Alliance, Ohio, 17 May 1928.

ALPHA GAMMA — University of South Dakota, Vermillion, South Dakota, 15 May 1928.

ALPHA DELTA — Lawrence College, Appleton, Wisconsin, 17 March 1929.

ALPHA EPSILON — University of Pittsburgh, Pittsburgh, Pennsylvania, 23 March 1929.

ALPHA ZETA — College of William and Mary, Williamsburg, Virginia, 19 April 1930.

ALPHA ETA — Oklahoma Agricultural and Mining College, Stillwater, Oklahoma, 13 March 1930.

ALPHA THETA — State College of Washington, Pullman, Washington, May 1930.

ALPHA IOTA — Bucknell University, Lewisburg, Pennsylvania, 9 January 1932.

ALPHA KAPPA — Hunter College, New York City, 8 January 1932.

ALPHA LAMBDA — University of Utah, Salt Lake City, Utah, 13 February 1932.

ALPHA MU — University and State College of Oregon, Eugene-Portland-Corvallis, Oregon, 18 November 1933.

ALPHA NU — University of New Mexico, Albuquerque, New Mexico, 21 April 1935.

ALPHA XI — University of Rhode Island, Kingston, Rhode Island, 17 May 1935.

ALPHA OMICRON — Marquette University, Milwaukee, Wisconsin, 18 June 1938.

ALPHA PI — University of Colorado, Boulder, Colorado, 24 May 1941.

ALPHA RHO — University of Arkansas, Fayetteville, Arkansas, 23 May 1945.

ALPHA SIGMA — University of Texas, Austin, Texas, 2 February 1946.

ALPHA TAU — National University of Mexico, Mexico, D.F., 7 April 1947.

ALPHA UPSILON — University of California at Los Angeles, California, 17 May 1947.

ALPHA PHI — College of Puget Sound, Tacoma, Washington, 28 February 1948.

ALPHA CHI — University of the Philippines, Manila, Luzon, P.I., 12 March 1949.

ALPHA PSI — Virginia Polytechnic Institute, Blacksburg, Virginia, 24 May 1949.

ALPHA OMEGA — University of Georgia, Athens, Georgia, 17 May 1951.

BETA ALPHA — Pennsylvania State Univ., State College, Pennsylvania, 26 May 1955.

BETA BETA — Florida State University, Tallahassee, Florida, 18 February 1956.

BETA GAMMA — Long Island University, Brooklyn, N. Y., 27 April 1957.